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U.S. Nuclear Regulatory Commission
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Washington, D.C. 20555

Subject: McGuire Nuclear Station, Unit 2
Docket Nos. 50-370
Licensee Event Report 370/02-02, Revision 0
Problem Investigation Process No.: M-02-04071

Pursuant to 10 CFR 50.73, Sections (a)(1) and (d), attached is Licensee Event Report (LER) 370/02-01, Revision 0.

On August 22, 2002, Operators manually tripped the Unit 2 reactor as a result of a hydrogen leak and fire on the turbine-generator hydrogen cooling system gas dryer. The fire brigade isolated the hydrogen source and extinguished the fire. See the attached LER for additional details.

This LER is being submitted as per the requirements of 10 CFR 50.73 (a)(2)(iv)(A). Probabilistic risk assessment has determined this event to be of no significance to the health and safety of the public. There are no regulatory commitments contained in this LER.

D. M. Jamil

Attachment

IE22

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U.S. Nuclear Regulatory Commission
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Atlanta Federal Center
61 Forsyth St., SW, Suite 23T85
Atlanta, GA 30323

INPO Records Center
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NRC FORM 366 (7-2001) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES 7-31-2004

Estimated burden per response to comply with this mandatory information collection request 50 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records Management Branch (T-6 E6), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to bjs1@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202 (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
McGuire Nuclear Station, Unit 2	05000 370	1 OF 7

4. TITLE
McGuire Unit 2 Manual Reactor Trip due to Rapid Loss of Generator Hydrogen and Subsequent Fire.

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MO	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO	MO	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
08	22	2002	2002	- 002 -	00	10	14	2002	FACILITY NAME	DOCKET NUMBER

9. OPERATING MODE	1
10. POWER LEVEL	100

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)

	20 2201(b)		20 2203(a)(3)(ii)		50 73(a)(2)(ii)(B)		50.73(a)(2)(ix)(A)
	20 2201(d)		20 2203(a)(4)		50 73(a)(2)(iii)		50.73(a)(2)(x)
	20 2203(a)(1)		50 36(c)(1)(i)(A)	X	50 73(a)(2)(iv)(A)		73 71(a)(4)
	20.2203(a)(2)(i)		50 36(c)(1)(ii)(A)		50.73(a)(2)(v)(A)		73 71(a)(5)
	20.2203(a)(2)(ii)		50.36(c)(2)		50.73(a)(2)(v)(B)		OTHER Specify in Abstract below or in NRC Form 366A
	20 2203(a)(2)(iii)		50.46(a)(3)(ii)		50.73(a)(2)(v)(C)		
	20 2203(a)(2)(iv)		50 73(a)(2)(i)(A)		50.73(a)(2)(v)(D)		
	20 2203(a)(2)(v)		50 73(a)(2)(i)(B)		50 73(a)(2)(vii)		
	20 2203(a)(2)(vi)		50 73(a)(2)(i)(C)		50 73(a)(2)(viii)(A)		
	20 2203(a)(3)(i)		50 73(a)(2)(ii)(A)		50 73(a)(2)(viii)(B)		

12. LICENSEE CONTACT FOR THIS LER

NAME	TELEPHONE NUMBER (Include Area Code)
Lee A Hentz, Regulatory Compliance	704-875-4187

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
A4b	TK	DRY		Yes					

14. SUPPLEMENTAL REPORT EXPECTED			15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE).	X	NO				

16. ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)

Unit Status: At the time of the event, Unit 1 and Unit 2 were in Mode 1 (Power Operation) at 100 percent power.

Event Description: On August 22, 2002, a pipe plug located on the bottom side of an oil vapor extractor canister housing on the generator hydrogen system dual tower gas dryer skid failed, resulting in a rapid loss of hydrogen and a fire. In response, operators manually tripped the Unit 2 reactor and dispatched the fire brigade. The fire brigade isolated the hydrogen source and extinguished the fire. Following the reactor and turbine trip, steam generator water levels continued to increase as a result of the 2B main feedwater pump turbine not going to the rollback hold position. Once the steam generator water levels reached their high-high setpoint, the main feedwater pumps automatically tripped due to a feedwater isolation signal. The loss of the main feedwater pumps resulted in an automatic start of the 2A and 2B motor driven auxiliary feedwater pumps.

Event Cause: Inadequate maintenance work practices and a lack of proper coordination of a functional verification were the causes for this event.

Corrective Action: Inspected the fire affected area and performed appropriate repairs. Removed the Unit 2 dryer from service. Revised the dryer operating procedures to ensure proper functional verifications following maintenance. Other similar procedures and maintenance work practices will be reviewed and revised as appropriate.

FACILITY NAME (1)	DOCKET (2) NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
McGuire Nuclear Station, Unit 2	05000370	2002	- 002 -	00	2 OF 7

NARRATIVE *(If more space is required, use additional copies of NRC Form 366A)* (17)

BACKGROUND

The following information is provided to assist readers in understanding the event described in this LER. Applicable Energy Industry Identification (EIIS) system and component codes are enclosed within brackets. McGuire unique system and component identifiers are contained within parentheses.

Engineered Safety Features System [JE] (ESF)

The Engineered Safety Features (ESF) system initiates necessary safety systems, based on the values of selected parameters, in order to prevent or mitigate damage to the core and the reactor coolant system pressure boundary, and ensure containment integrity. The primary functions of the turbine trip and feedwater isolation signals are to prevent damage to the turbine due to water in the steam lines, and to stop the excessive flow of feedwater into the steam generators [AB-SG] (S/G). These functions are necessary to mitigate the effects of a high water level in the S/Gs which could result in carryover of water into the steam lines and excessive cooldown of the primary system. The turbine trip and feedwater isolation signals are both actuated by the S/G water level high-high signal (P-14). The P-14 actuation signal is designed to terminate the main feedwater contribution to a S/G overfill event. An overfill event could occur from conditions such as a S/G tube rupture or a feedwater control system mis-operation or failure. A P-14 actuation will isolate main feedwater and trip both main feedwater pump turbines and the main turbine.

Auxiliary Feedwater System [BA] (CA)

The Auxiliary Feedwater (CA) system assures required feedwater flow to the steam generators for reactor coolant heat removal when the main feedwater system is not available through loss of power or other malfunctions. The CA system is designed to start automatically for any event requiring emergency feedwater. Since the CA system is the only source of makeup water to the steam generators for reactor coolant heat removal when the CF system becomes unavailable, it has been designed with redundancy and diversity. The CA system contains two motor driven pumps [BA-P] and one steam turbine driven pump [BA-P] for each unit. The motor driven CA pumps will automatically start on a trip of both CF pumps.

Main Feedwater System [SJ] (CF)

The purpose of the Main Feedwater (CF) system is to take treated condensate, heat it further, and deliver it at the required flow rate, pressure and temperature to the steam generators. The CF System is designed to maintain proper S/G water levels with respect to reactor power output and turbine steam

FACILITY NAME (1)	DOCKET (2) NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
McGuire Nuclear Station, Unit 2	05000370	2002	- 002 -	00	3 OF 7

NARRATIVE *(If more space is required, use additional copies of NRC Form 366A)* (17)

requirements. There are two 50% capacity CF pumps [SJ-P] driven by two variable speed steam turbines [SJ-TRB] (CFPT). After a reactor trip, the CFPTs begin to coast down due to the loss of main steam until auxiliary steam is aligned to the turbines. To avoid a steam generator over-feed condition, a signal is sent to each CFPT speed control system to go to a rollback hold position. This limits the turbine speed to approximately 2750 rpm prior to the steam supply being re-established.

Turbine-Generator Hydrogen Cooling System [TK] (GH)

The Generator Hydrogen Cooling (GH) system circulates hydrogen gas within the turbine-generator frame to provide cooling for the stator and rotor. The hydrogen is circulated by a blower mounted on the generator shaft. The dual tower hydrogen gas dryer [TK-DRY] is the preferred means for hydrogen gas moisture removal and is normally aligned for service. Portions of the GH system are purged with carbon dioxide gas (CO2) prior to any maintenance to prevent an inadvertent air and hydrogen explosive mixture.

EVENT DESCRIPTION

At the time of the event on August 22, 2002, Unit 2 was in Mode 1 at 100 % power. All emergency core cooling systems and emergency diesel generators were fully operable. The turbine driven CA pump was out of service for flow balance testing but was available to feed the steam generators if necessary.

On August 19, 2002, Maintenance crews were scheduled to complete the three year preventative maintenance tasks on the Unit 2 dual tower hydrogen gas dryer. This work consisted of nine tasks that required coordination of four disciplines: Instrument and Electrical (IAE), Mechanical Maintenance (MM), Air Operated Valve (AOV) team, and Operations (OPS).

On August 22, 2002, all work was completed as scheduled. The individual discipline supervisors signed out of the block tag out so that the tags could be cleared and the functional verifications could be performed. The IAE supervisor asked to be contacted by OPS when the tags were ready to be cleared. Verbal arrangements were also made between the IAE supervisor and the MM team.

At approximately 1500, a MM technician walked by the dryer and observed OPS clearing the tags. The MM technician assisted OPS with connecting the CO2 supply to pressurize the dryer package, which is the required method for performing the pressure boundary functional verification. The MM technician completed a leak check of the components on which mechanical work had been performed. OPS then placed the dryer package in service and aligned it to the hydrogen system without contacting the IAE supervisor. The components that the IAE team had worked on were not inspected or leak checked. The leak

FACILITY NAME (1)	DOCKET (2) NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
McGuire Nuclear Station, Unit 2	05000370	2002	- 002 -	00	4 OF 7

NARRATIVE *(If more space is required, use additional copies of NRC Form 366A)* (17)

on the oil vapor extractor was not recognized by OPS or the MM technician at this time.

At approximately 1615, an IAE technician who was part of the team that replaced the carbon in the oil vapor extractor, walked to the dryer and noticed it had been placed in service. While at the dryer, the IAE technician heard a leak coming from the oil vapor extractor. He proceeded to the IAE shop and informed the IAE supervisor that the dryer was in service and a leak could be heard. The second IAE technician, also part of the same IAE team, hearing this conversation, went to the dryer and tightened the plug on the bottom of the oil vapor extractor. As the IAE technician was exiting the area, the drain plug blew out of the oil vapor extractor and the escaping hydrogen ignited.

At approximately 1632, a loud noise was heard within the plant. The control room received a fire detection alarm, and a GH system low pressure alarm at 69 psig.

At approximately 1633, the control room was notified of a fire at the hydrogen dryer in the Unit 2 turbine building. The fire brigade was activated. The Control room then entered AP/2/A/5500/004, rapid down power. GH system pressure was now approximately 60 psig.

At approximately 1636, GH system pressure had decreased to 55 psig. Since it was evident that the rapid down power could not be completed prior to losing adequate cooling to the turbine-generator, operations manually tripped the Unit 2 reactor. The main turbine then tripped on a reactor trip above the ESF P-8 (power range neutron flux) setpoint. The 2A CF pump went to the rollback hold position but the 2B CF pump failed to go to rollback hold.

At approximately 1638, the 2A and 2B S/G power operated relief valves (PORVs) briefly opened for about 15 seconds. Without the 2B CF pump in the rollback hold position, S/G water levels continued to increase.

At approximately 1639, the 2C S/G water level reached the ESF P-14 (high-high level) setpoint for feedwater isolation, thereby tripping the CF pumps and isolating the main feedwater system. The turbine trip signal was received but the turbine was already tripped. With both CF pumps tripped, the ESF system automatically started the 2A and 2B motor driven CA pumps.

At approximately 1642, a notification of an unusual event (NOUE) was declared based on the fire lasting greater than 15 minutes. A notification was subsequently made to the NRC Operations Center.

At approximately 1650, the fire brigade controlled the fire, isolated the hydrogen supply to the dryer, and extinguished the flames.

At approximately 1830, the facility exited the NOUE.

FACILITY NAME (1)	DOCKET (2) NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
McGuire Nuclear Station, Unit 2	05000370	2002	- 002 -	00	5 OF 7

NARRATIVE *(If more space is required, use additional copies of NRC Form 366A)* (17)

At approximately 2100, the S/G water levels returned to no load values.

CAUSAL FACTORS

Two root causes were identified for this event:

1. Inadequate maintenance work practices caused thread damage to the hydrogen dryer oil vapor extractor threads by over-tightening and cross-threading.

The bottom plug was ejected from the oil vapor extractor due to insufficient thread engagement. There was evidence that the plug had been cross-threaded in the extractor on the last re-installation, which would provide less thread engagement between the thread faces than usual.

2. The functional verification was inadequate to demonstrate that the hydrogen dryer oil vapor extractor would perform satisfactorily when returned to service with hydrogen.

The verbal agreements between work groups to be contacted when the dryer was pressurized with CO2 and ready for the functional verification were not upheld. No formal method existed to ensure that all the affected work groups were contacted to perform their respective functional verifications while the dryer was pressurized with CO2.

CORRECTIVE ACTIONS

Immediate:

1. The reactor was tripped due to lowering GH system pressure.
2. The hydrogen source was isolated and the fire was extinguished.
3. The dual tower dryer was removed from service.

Subsequent:

1. Detailed inspections were performed for the fire affected area focusing on fire and water damage. Minor repairs were made.
2. The dual tower dryer operating procedure for Unit 2 was deleted. The remaining hydrogen dryer operating procedures were revised to include detailed directions and expectations for performing leak checks while pressurized with CO2. Also, a hold point was added to ensure that all

FACILITY NAME (1)	DOCKET (2) NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
McGuire Nuclear Station, Unit 2	05000370	2002	- 002 -	00	6 OF 7

NARRATIVE *(If more space is required, use additional copies of NRC Form 366A)* (17)

functional verifications and inspections are completed prior to pressurizing with hydrogen if maintenance was performed on the dryer.

Planned:

1. Develop specific procedural guidance for working with or in a potential environment of flammable and hazardous systems, including the hydrogen dryers. Include cleaning, inspection, and restoration of components such as threaded connections.

2. Review other procedures dealing with flammable and hazardous systems for similar leak check and functional verification issues.

SAFETY ANALYSIS

Reactor trips and turbine trips are analyzed in Chapter 15 of the McGuire Nuclear Station Final Safety Analysis Report. Those analyses demonstrate that, given the plant conditions and sequence of events associated with the August 22, 2002 event, the plant design and response was adequate. Therefore, this event presented no hazard to the integrity of the Reactor Coolant System or the reactor fuel/cladding.

During the event, the unit experienced a manual reactor trip. Following the trip, the 2B main feedwater pump did not go to rollback hold, which led to an increase in secondary side water level in the steam generators. As designed, the transient was terminated by feedwater isolation and steam generator hi-hi level signals which tripped the main feedwater pumps.

Automatic actuation of the CA motor driven pumps occurred. Feedwater flow to the SGs was maintained by the CA System, ensuring adequate decay heat removal. Main feedwater could have been restored if desired by restarting the unaffected 2A main feedwater pump.

Given this and the availability of other plant equipment needed for initiating and maintaining adequate decay heat removal, the Conditional Core Damage Probability (CCDP) of this event is considered insignificant (estimated to be less than 1.0E-06).

The major contributors to Large Early Release Frequency (LERF) are the containment bypass sequences. The manual reactor trip event does not produce sequences that contribute significantly to the containment bypass plant damage state. Therefore, the impact on LERF is very small.

FACILITY NAME (1)	DOCKET (2) NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
McGuire Nuclear Station, Unit 2	05000370	2002	- 002 -	00	7 OF 7

NARRATIVE *(If more space is required, use additional copies of NRC Form 366A)* (17)

Given the above, this event is considered to be of no significance with respect to the health and safety of the public.

ADDITIONAL INFORMATION

A three year search of the McGuire corrective action database (PIP) revealed no other loss of GH events, no other hydrogen fires, and only one other equipment fire. This fire involved an instrument air system (VI) compressor motor and was caused by an electrical overload condition, not a human performance error. The motor fire was quickly extinguished and was not the cause of any plant transient. Therefore, this event is not recurring.